POSITIONS AND AREAS OF SUN SPOTS

[Communicated by Capt. C. S. Freeman, Superintendent U. S. Naval Observatory]

[Data furnished by Naval Observatory, in cooperation with Harvard, Yerkes, and Mount Wilson observatories]

Date	Eastern standard civil time	Heliographic		Area[1]	
		Longitude	Latitude	Spot	Group
1927	h. m.	°	°		
Aug. 1 (Naval Observatory)	12 0	−67.0	−16.5		62
		+0.5	+13.5	15	
		+38.0	+9.5		46
		+63.5	−11.0	247	
Aug. 2 (Naval Observatory)	11 49	−53.0	−17.5		93
		−34.0	−8.0		46
		−7.0	−17.0		31
		+51.0	+11.0		62
		+53.5	+20.5		31
		+78.0	−10.5	278	
Aug. 3 (Harvard)	13 23	−39.0	−17.0		319
		+68.0	+21.5		388
Aug. 4 (Naval Observatory)	14 26	−26.0	−17.5		62
		+23.0	−17.0		123
		+57.0	+11.5		31
		+83.0	+20.0		247
Aug. 5 (Naval Observatory)	11 52	−13.5	−17.5		46
		+34.5	−17.0		154
		+68.0	+11.5	15	
Aug. 6 (Naval Observatory)	11 36	−2.5	−18.5		15
		+22.5	−6.5		46
		+43.5	−15.0		62
		+50.5	−17.0		77
Aug. 7 (Naval Observatory)	11 38	+12.0	−18.5		15
		+37.0	−6.5		15
		+57.5	−15.0		62
		+65.0	−17.5		93
Aug. 8 (Harvard)	11 17	+10.5	+32.5	154	
		+72.5	−13.5	104	
Aug. 9 (Naval Observatory)	12 42	−77.0	−13.5	185	
		−66.5	−13.0	93	
Aug. 10 (Naval Observatory)	11 29	−62.5	−13.5		185
		−53.0	−12.5		93
Aug. 11 (Naval Observatory)	11 39	−50.0	−13.5		123
		−39.5	−12.0		77
		−33.0	−11.5		31
Aug. 12 (Naval Observatory)	11 40	−37.0	−13.5		93
		−27.5	−11.5		93
		−21.0	−10.5		93
Aug. 13 (Naval Observatory)	11 34	−22.5	−13.0		46
		−13.0	−11.0		46
		−8.0	−10.0		216
Aug. 14 (Harvard)	12 15	−64.5	−17.5		267
		−40.0	−6.5	122	
		+7.0	−9.5		872
Aug. 15 (Naval Observatory)	11 40	−53.5	−18.5		123
		−21.0	−7.5		15
		+18.5	−10.5		648
Aug. 16 (Naval Observatory)	11 44	−63.0	+11.0		93
		−57.5	+10.0		62
		−38.0	−18.5		247
		+32.0	−11.0		741
Aug. 17 (Naval Observatory)	11 45	−85.0	−10.5	309	
		−50.5	+10.5		31
		−42.5	+10.0	31	
		−24.0	−18.5		154
		+0.5	−8.0		93
		+46.0	−11.0		864

[1] Areas are corrected for foreshortening and are expressed in millionths of sun's visible hemisphere.

POSITIONS AND AREAS OF SUN SPOTS—Continued

Date	Eastern standard civil time	Heliographic		Area	
		Longitude	Latitude	Spot	Group
1927—Continued	h. m.	°	°		
Aug. 19 (Naval Observatory)	11 47	−58.0	−10.5	370	
		−25.0	+10.5	12	
		−18.0	+10.0	9	
		−13.5	+10.5	19	
		+5.5	−17.5	93	
		+27.5	−8.0		62
		+59.0	−13.0		62
		+72.0	−10.5		926
Aug. 20 (Yerkes)	9 26	−44.0	−9.0	125	
		−5.0	+10.0		150
		+17.0	−14.0	75	
Aug. 21 (Naval Observatory)	11 39	−55.0	+16.5	31	
		−31.0	−11.0	247	
		+9.0	+10.5		154
		+32.0	−17.0	108	
Aug. 22 (Yerkes)	9 50	−16.0	−9.5	150	
		+20.0	+10.0		150
		+44.0	−15.0	50	
Aug. 23 (Naval Observatory)	12 10	−66.0	−18.0		309
		−4.0	−10.5	278	
		+36.0	+11.0		370
		+59.0	−17.5	93	
Aug. 24 (Naval Observatory)	11 47	−55.5	−17.5		185
		−52.0	−18.0	216	
		+9.5	−10.5	278	
		+49.5	+10.5		370
		+73.0	−17.5	93	
August 25 (Yerkes)	9 17	−35.0	−15.5		75
		+20.5	−9.0	100	
		+59.0	+10.5		125
August 26 (Yerkes)	9 30	−27.0	−16.0		300
		+35.0	−9.0	100	
		+80.0	+11.0		125
August 27 (Yerkes)	9 9	−15.0	−15.5		300
		+48.0	−9.0	100	
August 29 (Naval Observatory)	11 31	−79.0	+7.0		31
		−48.0	−18.0		62
		+12.5	−18.0		494
		+77.0	−10.0		216
August 30 (Naval Observatory)	11 41	−72.0	−14.5	15	
		−38.0	−17.0		31
		−34.0	−18.0		46
		+27.0	−17.5		309
August 31 (Naval Observatory)	11 40	−62.0	−14.5		216
		−24.0	−17.5		93
		+39.0	−17.5		278

CORRECTED MEANS OF SUN SPOTS FOR JULY 22 AND 29, 1927

Date	E. S. T.	Hel. lat.	Hel. long.	Area
	h. m.	°	°	
July 22 (Yerkes)	18 2	−9.5	−65.0	450
		+21.5	−34.0	100
July 29 (Yerkes)	10 19	−8.0	+23.5	
		+24.5	+52.5	

AEROLOGICAL OBSERVATIONS

By W. R. STEVENS

The averages for the aerological stations, given in Tables 1 and 2, show some important departures from the normal. Free-air temperatures were below the average at Broken Arrow, Ellendale, Royal Center, and Washington, near normal at Groesbeck, and below normal at Due West near the surface, with positive departures at higher levels. Ordinarily, departures from average, or normal, decrease in magnitude with increasing altitude, but we find the opposite relationship existed for the month at Due West, Ellendale, Royal Center, and Washington. Lowest temperatures of record for August were observed at Broken Arrow from 1,250 to 5,000 meters, from the surface to 1,250 meters at Due West, and from 3,000 to 4,000 meters at Groesbeck. Highest temperatures of record for August were observed at Due West from 1,000 to 3,000 meters.

Free-air relative humidities were mostly below average at Groesbeck, Royal Center, and Washington, and above average at Broken Arrow, Due West, and Ellendale.

Vapor pressures were mostly below average.

Resultant winds, as determined by kites, show that in general a more northerly component than usual prevailed over all stations with the exception of Due West and Ellendale. Nevertheless, at the latter station temperatures were subnormal by 2° C. or more at all observed levels.

The lowest temperature recorded at the surface during the month at Ellendale was on the 9th in the rear of a HIGH, where the surface wind had shifted to southerly. We find a fall of 4.7° C. from the 8th to the 9th at the surface with a wind shift from NNW. to SSW. At an altitude of 2,000 meters, however, there was a rise of 4.3° C. with a shift from NNW. to W. It is quite obvious that the inversion off the ground on the 9th was not due to a wedgelike advance of cold air, but rather to a rapid increase in temperature aloft.

Meteorological conditions over Ellendale, N. Dak., August 8–9, 1927

Time	8th Altitude	8th Temperature	Wind Direction	Wind Velocity	Time	9th Altitude	9th Temperature	Wind Direction	Wind Velocity
	meters	°C.				meters	°C.		
6:33 a. m.	444	10.7	NNW	6.3	6:32 a. m.	444	6.0	SSW	2.2
	500	10.5	NNW	6.5		500	6.8	SSW	3.5
	750	9.6	NNE	7.5		750	10.6	SW	9.1
	1,000	8.3	NNE	7.8		1,000	11.8	SW	11.2
	1,250	6.8	N.	7.9		1,250	10.6	WSW	9.7
	1,500	5.2	N.	10.7		1,500	9.4	WSW	8.3
	2,000	2.7	NNW			2,000	7.0	W	5.4

A double-theodolite pilot-balloon observation of 85 minutes was made at Groesbeck on the 9th. This is the longest, but not the highest, two-theodolite ascension made at that station since it was established. The observation was made in the southwest quadrant of a high-pressure area which was central over the upper Mississippi Valley. From the second to the sixth minute the balloon ascended at a rate of only 37 m. p. m. instead of the standard inflation rate of 180 m. p. m., which indicates the presence of a descending current of 2.4 m. p. s. After the seventh minute the rate increased, the mean rate from the tenth to the eighty-fifth minute being 188 m. p. m.

On the morning of the 13th a pilot balloon was observed at Groesbeck with one theodolite for 105 minutes. If the balloon ascended at the normal rate throughout the entire ascent, it would have reached an altitude of over 19 km. Another ascension was made immediately afterward in order to check the first. The second observation showed a decrease in velocity from 500 to 1,000 meters. This was to be expected, since velocities near the surface generally decrease rapidly after sunrise. The velocities showed a marked similarity from 1 to 7 kilometers. Above this level the second ascent showed slightly increased velocities. This appears to be correct, as the observation on the afternoon of this date showed a general increase in velocities over those recorded in the morning. While the second ascent did not reach quite as high as the first, there seems to be no doubt as to the accuracy of the first observation because of the absence of high velocities which would certainly have been recorded had the balloon failed to ascend.

The highest kite flight since the station was established was made at Royal Center on the 1st, when an altitude of 6,013 meters was reached. The observation was made in front of a moderate area of high pressure which covered the northern Plains States and the Canadian Northwest. The wind was west at all altitudes observed except near the surface, where it shifted toward the end of the flight to north-northwest. The wind velocity gradually increased from 4.0 m. p. s. at the surface to 15.5 m. p. s. at the maximum altitude. The descent showed an increase in velocity over the ascent which was most marked in the lower levels.

A number of successful free-rising captive-balloon ascents were made at Due West and Royal Center during the month when winds were too light for kites. The highest ascent made by this method was to an altitude of 2,991 meters at Due West on the 22d. On this date an extensive area of high pressure covered the eastern half of the country.

TABLE 1.—*Free-air temperatures, relative humidities, and vapor pressures during August, 1927*

TEMPERATURE (°C.)

Altitude, m. s. l. (meters)	Broken Arrow, Okla. (233 meters) Mean	Broken Arrow, Okla. Departure from 10-year mean	Due West, S. C. (217 meters) Mean	Due West, S. C. Departure from 7-year mean	Ellendale, N. Dak. (444 meters) Mean	Ellendale, N. Dak. Departure from 10-year mean	Groesbeck, Tex. (141 meters) Mean	Groesbeck, Tex. Departure from 9-year mean	Royal Center, Ind. (225 meters) Mean	Royal Center, Ind. Departure from 10-year mean	Washington, D. C.* (7 meters) Mean	Washington, D. C.* Departure from 3-year mean
Surface	23.5	−3.2	25.1	−0.9	17.7	−2.5	26.5	−0.4	21.2	−2.4	25.1	+0.7
250	23.4	−3.2	24.8	−0.8			25.8	−0.2	21.0	−2.4	23.1	−0.2
500	22.0	−3.2	22.7	−0.4	17.7	−2.4	24.6	+0.3	19.5	−1.8	21.2	−1.1
750	21.2	−2.8	21.1	−0.3	17.2	−2.0	24.0	+0.7	18.0	−1.6	19.7	−1.3
1,000	20.5	−2.3	20.1	+0.2	16.1	−2.0	22.9	+0.7	16.4	−1.6	18.3	−1.4
1,250	19.4	−1.9	18.9	+0.5	14.6	−2.2	21.5	+0.6	14.8	−1.7	16.8	−1.4
1,500	18.1	−1.6	17.4	+0.5	13.0	−2.4	19.9	+0.4	13.4	−1.7	15.3	−1.3
2,000	15.1	−1.2	14.8	+0.7	9.9	−2.6	16.8	+0.2	9.8	−2.5	12.4	−1.4
2,500	12.2	−0.7	12.2	+1.1	6.7	−2.8	13.5	−0.2	7.3	−2.4	9.8	−1.2
3,000	8.8	−0.9	10.3	+1.9	3.5	−3.0	10.3	−0.7	4.3	−2.6	6.4	−1.6
3,500	5.7	−0.7	8.7	+3.0	1.0	−2.6	7.3	−1.2	1.2	−3.0		
4,000	3.2	−0.3	7.4	+4.5	−1.4	−2.2	5.7	−0.4	−1.4	−3.1		
4,500	0.1	−0.2	6.0	+5.2	−4.4	−2.2			−3.5	−3.1		
5,000	−2.9	−0.3	5.7	+5.9	−8.6	−3.7			−6.6	−3.1		

RELATIVE HUMIDITY (%)

Surface	77	+10	67	−1	73	+7	72	−1	65	−1	67	−7
250	77	+10	68	0			72	−2	65	−1	68	−4
500	74	+10	72	+1	71	+7	69	−5	60	−5	68	−2
750	68	+6	73	+1	65	+5	61	−7	60	−6	66	−2
1,000	66	+5	72	0	64	+6	58	−5	59	−8	64	−3
1,250	67	+6	72	0	66	+9	59	−2	58	−9	64	−3
1,500	67	+6	75	+4	68	+11	60	−1	60	−6	68	−1
2,000	66	+4	76	+8	67	+12	58	−2	64	+1	67	−2
2,500	66	+4	77	+9	70	+16	59	0	55	−2	62	−4
3,000	73	+11	71	+4	72	+19	58	+2	59	+6	59	−1
3,500	75	+13	78	+9	65	+15	52	+3	59	+10		
4,000	59	+1	79	+9	49	+1			50	+2		
4,500	55	−1	87	+15	47	0			50	0		
5,000	43	−7	50	+1	44	0			46	0		

VAPOR PRESSURE (mb.)

Surface	22.57	−0.21	21.29	−1.17	14.63	−0.41	24.42	−0.84	16.27	−2.84	21.74	−1.19
250	22.33	−0.27	21.11	−1.03			23.57	−0.89	16.06	−2.84	19.92	−1.01
500	19.82	−0.43	19.48	−0.43	14.20	−0.47	21.06	−1.09	13.76	−2.91	17.79	−1.43
750	17.49	−0.72	18.08	−0.17	12.66	−0.38	17.60	−1.54	12.50	−2.75	15.79	−1.50
1,000	16.15	−0.47	16.90	+0.16	11.61	−0.19	15.77	−0.85	11.07	−2.98	14.17	−1.49
1,250	15.02	−0.16	15.85	+0.56	10.89	+0.14	14.65	−0.29	9.84	−2.95	12.94	−1.40
1,500	13.77	−0.01	15.07	+1.29	10.11	+0.33	13.49	−0.16	9.21	−2.28	12.35	−0.97
2,000	11.46	+0.03	12.89	+1.95	8.26	+0.37	10.66	−0.56	7.86	−1.17	9.79	−1.30
2,500	9.65	+0.47	10.94	+1.98	6.98	+0.55	8.85	−0.38	5.78	−1.03	7.28	−1.43
3,000	8.59	+1.25	8.99	+1.69	5.85	+0.56	7.27	−0.21	4.90	−0.29	5.05	−1.23
3,500	6.97	+1.22	8.85	+2.61	4.54	+0.29	6.29	+0.48	3.95	−0.02		
4,000	4.4	+0.24	8.23	+2.87	3.03	−0.42			2.88	−0.45		
4,500	3.2	+0.17	8.17	+3.26	2.32	−0.47			2.48	−0.21		
5,000	2.0	+0.07	4.68	+2.05	0.98	−1.15			1.87	−0.21		

*Naval Air Station, Anacostia, D. C.

TABLE 2.—*Free-air resultant winds (m. p. s.) during August, 1927*

Altitude m. s. l. (meters)	Broken Arrow, Okla. (233 meters) Mean Dir.	Mean Vel.	10-year mean Dir.	10-year mean Vel.	Due West, S. C. (217 meters) Mean Dir.	Mean Vel.	7-year mean Dir.	7-year mean Vel.	Ellendale, N. Dak. (444 meters) Mean Dir.	Mean Vel.	10-year mean Dir.	10-year mean Vel.	Groesbeck, Tex. (141 meters) Mean Dir.	Mean Vel.	9-year mean Dir.	9-year mean Vel.	Royal Center, Ind. (225 meters) Mean Dir.	Mean Vel.	10-year mean Dir.	10-year mean Vel.	Washington, D. C. (34 meters) Mean Dir.	Mean Vel.	7-year mean Dir.	7-year mean Vel.
Surface	S. 54°E.	2.5	S. 2°E.	3.2	N. 53°W.	1.0	N. 70°W.	0.3	S. 7°W.	1.1	S. 20°W.	0.9	S. 29°W.	3.8	S. 17°W.	3.1	S. 45°E.	0.2	S. 55°E.	1.2	N. 6°W.	1.0	N. 32°W.	0.5
250	S. 53°E.	2.5	S. 2°E.	3.4	N. 53°W.	1.0	N. 75°W.	0.4					S. 31°W.	5.4	S. 18°W.	4.2			S. 56°W.	1.5	N. 43°W.	1.9	N. 52°W.	1.1
500	S. 30°E.	2.4	S. 11°W.	4.9	N. 68°W.	1.8	N. 69°W.	0.9	S. 4°E.	1.5	S. 18°W.	1.3	S. 32°W.	7.5	S. 23°W.	5.9	S. 76°W.	1.3	S. 64°W.	3.0	N. 15°W.	2.3	N. 50°W.	1.9
750	S. 12°W.	2.4	S. 19°W.	5.4	N. 66°W.	1.8	N. 73°W.	1.0	S. 16°W.	2.5	S. 23°W.	2.5	S. 31°W.	7.3	S. 22°W.	6.1	S. 86°W.	1.8	S. 71°W.	4.0	N. 32°W.	1.9	N. 51°W.	2.3
1,000	S. 25°W.	2.9	S. 27°W.	5.7	S. 86°W.	2.7	N. 81°W.	1.3	S. 22°W.	3.2	S. 37°W.	2.6	S. 31°W.	6.5	S. 21°W.	6.0	N. 88°W.	1.7	S. 78°W.	4.9	N. 54°W.	2.0	N. 58°W.	2.8
1,250	S. 56°W.	3.3	S. 33°W.	5.5	S. 79°W.	3.8	N. 83°W.	1.8	S. 29°W.	2.9	S. 49°W.	2.9	S. 30°W.	5.0	S. 20°W.	5.4	N. 70°W.	1.8	S. 83°W.	5.4				
1,500	S. 62°W.	4.7	S. 41°W.	5.5	S. 77°W.	6.0	N. 88°W.	2.7	S. 49°W.	2.9	S. 60°W.	3.5	S. 34°W.	4.0	S. 19°W.	4.7	N. 66°W.	2.0	S. 88°W.	6.2	N. 55°W.	4.3	N. 61°W.	4.2
2,000	S. 85°W.	6.6	S. 50°W.	5.0	S. 81°W.	6.6	N. 85°W.	3.7	S. 65°W.	2.9	S. 75°W.	4.6	S. 42°W.	3.1	S. 12°W.	3.7	N. 67°W.	3.2	W.	7.2	N. 72°W.	5.6	N. 65°W.	4.9
2,500	N. 81°W.	7.6	S. 54°W.	5.1	S. 81°W.	9.7	N. 86°W.	4.8	S. 81°W.	5.1	S. 86°W.	8.2	S. 58°W.	2.3	S. 13°W.	3.6	N. 78°W.	3.8	N. 86°W.	8.5	N. 77°W.	8.0	N. 71°W.	5.9
3,000	N. 78°W.	8.8	S. 56°W.	5.4	S. 78°W.	12.4	W.	6.3	N. 88°W.	8.0	W.	8.7	N. 68°W.	3.3	S. 20°W.	3.4	N. 86°W.	4.3	N. 84°W.	10.0	N. 82°W.	10.3	N. 73°W.	7.1
3,500	N. 81°W.	9.7	S. 52°W.	6.7	S. 77°W.	13.4	S. 84°W.	9.0	N. 74°W.	12.2	N. 84°W.	11.4	N. 36°W.	11.8	S. 27°W.	4.0	S. 89°W.	9.6	N. 84°W.	11.2	N. 58°W.	13.3	N. 73°W.	7.6
4,000	N. 80°W.	10.7	S. 63°W.	7.7	S. 78°W.	13.1	S. 85°W.	9.9	N. 79°W.	14.3	N. 82°W.	11.9	N. 37°W.	10.8	S. 50°W.	2.5	W.	10.1	N. 85°W.	12.3	N. 48°W.	12.1	N. 71°W.	7.8
4,500	N. 72°W.	14.2	S. 82°W.	8.4	S. 75°W.	14.8	S. 86°W.	12.1	N. 80°W.	14.5	N. 84°W.	12.5	N. 45°W.	14.0	S. 21°W.	1.1	W.	12.0	N. 82°W.	13.1	N. 89°W.	11.5	N. 74°W.	7.5
5,000	N. 69°W.	11.8	N. 82°W.	12.2	S. 68°W.	16.0	S. 72°W.	15.0	S. 88°W.	14.5	N. 84°W.	13.4					W.	13.0	W.	13.0	S. 38°W.	20.0	N. 70°W.	6.9